

2005 DESIGNER GENES**SOUTHERN POLY STATE UNIVERSITY REGIONAL**

Directions: Record your answers on the Participant Response Sheet.

- *1. A true-breeding plant with yellow seed is crossed to a true-breeding plant with green seeds. All of the F₁s are yellow. The F₁s are allowed to self. What fraction of the F₂s will be true breeding?
- A. 1/4
 - B. 1/2
 - C. 3/4
 - D. 4/4
- *2. Which of the following is true of a recessive trait?
- A. It requires two identical alleles for expression.
 - B. It requires either 1 or 2 alleles for expression
 - C. It is usually present in every generation
 - D. It can only occur if both parents also show the trait.
- *3. Two brown cows are mated, and the calf is white. Which of the following statements best describes this situation?
- A. Brown is dominant, and the next calf has a 3/4 chance of being white.
 - B. Brown is dominant and the next calf has a 1/4 chance of being white.
 - C. White is dominant, and the next calf has a 3/4 of being white.
 - D. White is dominant and the next calf has a 3/4 chance of being brown.
4. A dog with black hair mates with a dog with tan hair. The pups are 3 black and 2 tan. What can be concluded from this cross?
- A. Black is dominant and tan is recessive
 - B. Tan is dominant and black is recessive
 - C. Both parents are heterozygous
 - D. One parent is heterozygous and one is homozygous
- *5. Two individuals, each heterozygous for four different genes, A, B, C, and D, are mated. How many different phenotypes do you expect in the progeny if strict dominance is involved for each gene?
- A. 4
 - B. 8
 - C. 16
 - D. 256
6. In the following cross, Aa Bb Cc X aa bb cc what fraction of the progeny is expected to show three dominant traits?
- A. 1/8
 - B. 1/4
 - C. 3/8
 - D. 1/2
7. White eyes is X-linked recessive and short bristles is autosomal recessive. A true breeding white, long female is crossed with a true breeding red, short male. If the F₁s are allowed to interbreed, what fraction of the F₂ males will be white and short?
- A. 1/8
 - B. 1/4
 - C. 3/8
 - D. 3/4

8. A cross between a tall, red plant and a tall, white plant produced

45	tall red
42	tall white
16	short red
14	short white

Which of the following statements is the best conclusion that can be drawn from this cross?

- A. Both parents are heterozygous for both genes.
 - B. The parents are heterozygous for red and homozygous for tall.
 - C. One of the tall parents is homozygous.
 - D. The parents are heterozygous for tall and homozygous for either red or white.
9. In humans, colorblindness is an X-linked recessive trait. A color blind woman and a color blind man have a normal vision son. What is the best explanation for this observation?
- A. The woman had an affair, and the offspring is not her husband's child.
 - B. The child can be their child.
 - C. The child is either adopted or was accidentally switched at the hospital.
10. White eyes is X-linked recessive and red is X-dom. A true breeding white eyed female is mated to a red eyed male. Which of the following correctly lists the expected F1 progeny?
- A. All red eyes of both sexes.
 - B. All white eyes of both sexes.
 - C. All red females and all white males.
 - D. All white female and all red males.

Directions for questions 11-16: Matching. Answers may be used more than once or not at all. Each term will have only one answer, Use capital letters only.

- | | |
|---|------------------------|
| 11. Passed only from mothers to daughters | A. Autosomal dominant |
| 12. Passed only from fathers to sons | B. Autosomal recessive |
| 13. An affected female will have all affected sons | C. X-linked dominant |
| 14. An affected male will have all affected daughters | D. X-linked recessive |
| 15. An affected woman may have all affected children | E. Y-linked |
| 16. Two normal parents will have an affected child | F. None of these |

Directions for questions 17-19: Identify the common name for each of the following chromosomal anomalies?

- 17. Trisomy 21
- 18. XY
- 19. XXY

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Directions for questions 20-22: Match the type of disease with its most likely mutagenic causative agent

- 20. lung cancer A. Viruses
- B. Ultraviolet light
- 21. skin cancer C. Chemicals

- 22. birth defects

Directions for questions 23-25: Match the following procedures with their appropriate use.

- 23. Northern blotting A. Transferring proteins to filter paper
- B. Transferring DNA to filter paper
- 24. Southern blotting C. Transferring RNA to filter paper

- 25. Western blotting

Directions for questions 26-28: Match the type of bacterial “sex” with a definition of the process.

- 26. Conjugation A. Free DNA is picked up by bacterial cells
- B. Two bacterial cells become attached
- 27. Transformation C. Viruses transfer information from one cell to another

- 28. Transduction

Directions for questions 29-30: A person has the following chromosome composition: 48, XXXY

- 29. What is the “apparent” sex of this individual?
- 30. How many Barr bodies does this person have?
- 31. In a case of incomplete dominance involving one gene, what phenotypic ratio is expected if two heterozygotes are mated?
- 32. The genetic makeup an individual is the _____

Directions for questions 33-35: DNA fingerprints are run in a paternity suit. The DNA from the mother, two suspected fathers and the child appear below.

- 33. What is the name of the enzymes that are used to cut the DNA into fragments?
- 34. What procedure is used to separate the fragments?
- 35. Which male, 1, or 2, is most likely the father of the child. Remember, that each parent contributes half of the genetic information of a child. (2)

Child	Mother	Man 1	Man 2
_____	_____		_____
_____	_____	_____	
_____	_____	_____	_____
_____		_____	_____

36. In a population that is in Hardy Weinberg equilibrium, 1/1600 individuals has a rare genetic recessive disorder. What is the expected frequency of heterozygotes? (2)
- A. 1/40
 B. 2/40
 C. 78/100
 D. 78/1600

Directions for questions 37-38: Consider the following cross: Aa Bb Cc Dd Ee X Aa Bb Cc Dd Ee

37. How many different kinds of gametes can each parent produce?
38. How many different *genotypes* be produced among all the offspring from the above cross?
39. Galactosemia is an autosomal recessive disorder. If two individuals, each heterozygous for galactosemia, have two kids. What is the chance that both kids will be normal? Express your answer as a fraction.

Directions for questions 40-41: Achondroplasia is a type of dwarfism. Two dwarfs marry and have a dwarf child followed by a normal child.

40. Is dwarfism dominant or recessive?
41. What is the chance that their next child will be normal?

Directions for questions 42-43: For the following cross – Aa bb Cc DD Ee X Aa Bb Cc dd ee

42. What is the chance of getting an individual who shows all dominant traits? Express answer as a fraction.
43. What is the chance of getting an individual who shows all recessive traits? Express answer as a fraction.

Directions for questions 44-46: A population of turtles has the following genotype frequencies.

Freq AA	freq Aa	freq aa
0.81	0.02	0.17

44. What is the frequency of the A allele? Express answer as a decimal.
45. What is the frequency of the a allele? Express answer as a decimal.
46. Is this population in Hardy Weinberg equilibrium? Answer yes or no.

Directions for questions 47-48: In *Drosophila*, “singd bristles” is an X-linked recessive gene; brown eyes are an autosomal recessive gene. A true breeding red eyed, singd bristle female is mated with a true breeding brown eyed, long bristle male.

47. What is the phenotype of the F1 females?
48. What fraction of the F1 males will have brown eyes?

49. In chickens $C-ii$ is colored, $C-I-$ is white, and $ccii$ and $ccI-$ are white. If two individuals heterozygous for both genes are crossed, what fraction of the progeny is expected to be white?

Directions for questions 50-51: When true-breeding round eye female *Drosophila* are mated with true-breeding slit eyed males all the female F1s have kidney-shaped eyes, and all the male F1s have round eyes.

50. Is slit eyes autosomal or X-linked ?

51. If the F1s are selfed, what fraction of the F2 males is expected to have kidney shaped eyes?

52. Mother and father both can taste phenyl thiourea; two of their four children can not taste it. If the ability to taste is controlled by one gene, is tasting dominant or recessive?

53. Color-blindness is an X-linked recessive trait in humans. A normal visioned woman, whose father was color blind, and a normal visioned man have a daughter who is color blind. The daughter has only one X chromosome. In which parent did the sex chromosomes fail to separate during meiosis? (2)

54. A cross produced 1830 normal pigmented individuals and 625 albinos. What conclusion can be made?

- A. One parent is homozygous for albinism.
- B. Both parents are heterozygous.
- C. Albinism is a dominant trait.
- D. Both parents were homozygous
- E. 1205 albino zygotes failed to develop.

55. Two parents have heterozygous Tay-Sachs disease, an autosomal recessive disorder. What is the probability that the first child will also have a homozygous genotype?

56. In the ABO blood system in humans, the genotypes AA and AO have type A blood; the genotypes BB and BO have type B blood; the genotype OO has type O blood; and the genotype AB has type AB blood.

Mary has type A blood and her husband has type B blood. Her husband's parents both had type AB. They have three children, one with type A, one with type AB, and one with type B. Relatives suspect that one of the children was adopted. What is the blood type of the adopted child?